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मानक

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“Step Out From the Old to the New”

IS 3953 (1966): High temperature ceramic combustion boats  
[CHD 10: Glassware]



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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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IS : 3953 - 1966  
Reaffirmed - 2012

*Indian Standard*

**SPECIFICATION FOR  
HIGH TEMPERATURE COMBUSTION  
BOATS**

(First Reprint SEPTEMBER 1981)

UDC 542.232[66.049]



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**INDIAN STANDARDS INSTITUTION**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

*June 1967*

***Indian Standard***  
**SPECIFICATION FOR**  
**HIGH TEMPERATURE COMBUSTION**  
**BOATS**

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**AMENDMENT NO. 1      OCTOBER 1976**  
**TO**  
**IS:3953-1966   SPECIFICATION FOR HIGH**  
**TEMPERATURE COMBUSTION BOATS**

**Alteration**

*(First cover page and pages 1 and 3,*  
*Title)* - Substitute the following for the  
existing title at all the places:

**'SPECIFICATION FOR HIGH TEMPERATURE  
CERAMIC COMBUSTION BOATS'**

**(CDC 27)**

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Reprography Unit, ISI, New Delhi

***Indian Standard***  
**SPECIFICATION FOR**  
**HIGH TEMPERATURE COMBUSTION**  
**BOATS**

**0. FOREWORD**

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 11 October 1966, after the draft finalized by the Ceramicware Sectional Committee had been approved by the Chemical Division Council.

**0.2** High temperature combustion boats are used in the estimation of carbon and sulphur in steel samples. The temperature of the furnace in which the boats are kept is maintained between 1 100° to 1 300°C as the case may be.

**0.3** Till recently combustion boats were used to be imported. The possibility of successful manufacture of combustion boats in the country from indigenous raw materials has been investigated under the auspices of the Central Glass and Ceramic Research Institute, Calcutta and the Research, Designs and Standards Organization, Ministry of Railways. This standard is based on the experience of Central Glass and Ceramic Research Institute in manufacturing such combustion boats to meet the requirements of the consumers.

**0.4** Assistance has been derived in the preparation of this standard from the following publication:

DEV (S R) and LELE (R V). Manufacture of high temperature combustion boats. *CG & CRI Bulletin*. 10, 4; 1963; 102-114.

**0.5** For the purpose of deciding whether a particular requirement of this standard is complied with, the final values, observed or calculated, expressing the results of a test, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off values should be the same as that of the specified values in this standard.

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**1. SCOPE**

**1.1** This standard prescribes the requirements and the methods of sampling and test for high temperature combustion boats used in the estimation of carbon and sulphur in steel.

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\*Rules for rounding off numerical values (*revised*).



# IS : 3953 - 1966

## 2. TERMINOLOGY

**2.1** For the purpose of this standard, the definitions given in IS : 2781-1964\* shall apply.

## 3. REQUIREMENTS

**3.1 Material and Manufacture** — The combustion boat shall be made of ceramic bodies having suitable chemical and thermal properties.

**3.2 Porosity** — The water absorption shall be not more than 3 percent when determined in accordance with the method given in Appendix A.

**3.3 Shape** — The boat shall conform to the shape shown in Fig. 1. The bottom may be provided with a ridge about 1 mm high all around to give it a stable footing in case the marking of the manufacturer is embossed at the bottom.

**3.4 Dimensions** — The boats shall conform to the dimensions given below:

<i>Sl No.</i>	<i>Length</i>	<i>Width at the Top</i>	<i>Height</i>	<i>Width at the Base, Max</i>
(1)	(2)	(3)	(4)	(5)
	mm	mm	mm	mm
i)	80±2	12±1	10±1	9.5
ii)	90±2	15±1	10±1	9.5
iii)	120±2	17±1	12±1	12.0

**3.5** The draw hole shall preferably be rectangular having dimensions about 3 × 5 mm to facilitate withdrawal from the heated furnace tube.

## 4. MARKING

**4.1** The boats shall be legibly marked, preferably by embossing at the side of boat with the name of the manufacturer and his trade-mark, if any.

**4.1.1** In case the markings are embossed at the bottom, those shall be less than 1 mm high, the latter being the ridge height.

**4.2** The boats may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is

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\*Glossary of terms relating to ceramicware.

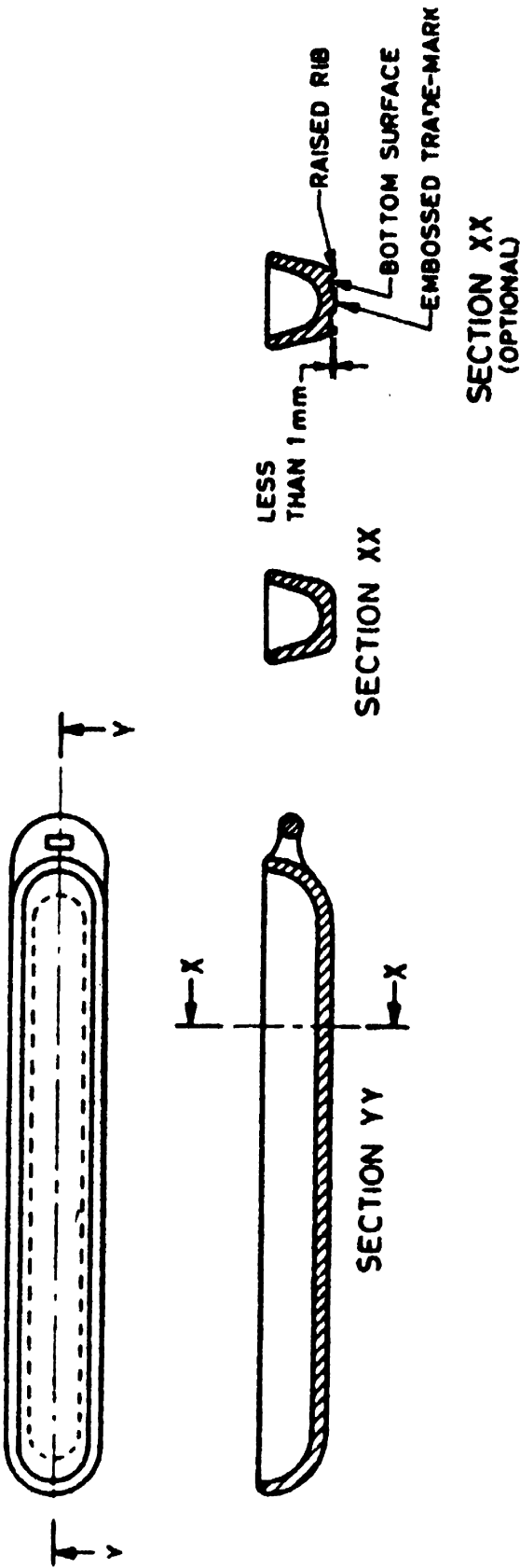


FIG. 1 COMBUSTION BOAT

## IS : 3953 - 1966

devised and supervised by ISI and operated by the producer, ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

### 5. PACKING

**5.1** The boats shall be suitably packed as agreed to between the purchaser and the supplier.

### 6. SAMPLING

**6.1** Representative samples of the boats shall be drawn and their conformity to this specification shall be determined in accordance with the methods described in Appendix B.

### 7. TESTS

**7.0 General** — The combustion boats are used for temperatures between 1 100° to 1 400°C. Before testing (**7.1** and **7.2**) the temperatures of test shall be predetermined depending on the temperature of use.

**7.1 Thermal Shock Test** — Quickly insert the combustion boat inside a tube furnace maintained at 1 100° or 1 400°C according to the requirement, and take it out after 3 minutes. Examine the boat visually for cracks, if any, after cooling to room temperature. Subject the boat to two cycles of test. The boat shall not show any cracks or distortion in shape.

**7.2 Slag Resistance Test** — Quickly insert a boat containing a few grams of iron scrappings and a lead foil or red oxide of lead, in a tube furnace maintained at 1 100° or 1 400°C, according to the requirement. Take out the boat after 5 minutes. Repeat the test for two cycles. The boat shall not show any black mark on its bottom, indicating penetration of molten iron.

## A P P E N D I X A

(*Clause 3.2*)

### DETERMINATION OF POROSITY

#### A-0. OUTLINE OF THE METHOD

**A-0.1** The amount of water absorbed by the boat is determined by boiling it in water and finding the increase in weight.

**A-1. PROCEDURE**

**A-1.1** Clean the boat with distilled water and dry to a constant weight at a temperature between 110° to 115°C and then cool to room temperature in a desiccator. Weigh the boat accurately to 0.01 g. Immerse the boat in distilled water in a beaker and boil for 2 hours. Use a few glass beads in such a way that the boat does not touch the bottom of the beaker. After boiling allow the boat to cool to room temperature and let it remain in water for 20 hours. Then take it out, wipe carefully with a soft, damp cloth to remove the excess moisture sticking to the surface, and weigh accurately to 0.01 g.

**A-2. CALCULATION**

**A-2.1** Calculate the water absorption as follows:

$$\text{Percentage water absorption} = \frac{W_2 - W_1}{W_1} \times 100$$

where

$W_2$  = weight of the boat after boiling with water, and

$W_1$  = weight of the dry boat.

**APPENDIX B**

*(Clause 6.1)*

**SAMPLING OF COMBUSTION BOATS****B-1. SCALE OF SAMPLING**

**B-1.1 Lot** — All the combustion boats of the same dimensions produced under essentially similar conditions of manufacture and offered for inspection at the same time shall be regarded as constituting a lot.

**B-1.2** The conformity of the lot to the requirements of this specification shall be ascertained separately for each lot. The number of articles to be selected for this purpose shall depend on the size of the lot and shall be in accordance with col 1 and 2 of Table 1.

**B-1.3** The samples shall be selected at random from the lot. To ensure randomness of selection, use shall be made of random number tables.

**TABLE 1 NUMBER OF SAMPLES***(Clause B-1.2)*

No. OF BOATS IN THE LOT	NO. OF BOATS TO BE SELECTED IN THE SAMPLE	PERMISSIBLE No. OF DEFECTIVES FOR REQUIREMENTS OTHER THAN 3.2, 7.1 AND 7.2	No. TO BE TESTED FOR 7.1 AND 7.2	PERMISSIBLE No. OF FAILURES IX 7.1 AND 7.2	NO. TO BE TESTED FOR 3.2
(1)	(2)	(3)	(4)	(5)	(6)
Up to 100	12	1	3	0	3
101 „ 500	20	2	5	0	4
501 „ 3 000	32	3	8	1	5
3 001 „ 5 000	50	5	13	2	6
5 001 and over	80	7	20	3	7

If random number tables are not available the following procedure shall be adopted:

'Starting from any article in the lot count them in one order as 1, 2, 3, . . . . ., etc up to  $r$  and so on where  $r$  is the integral part of  $N/n$  ( $N$  being the number of articles in the lot and  $n$  the number of articles in the sample). Every  $r$ th article thus counted shall be withdrawn to constitute the sample.'

**B-1.3.1** In case the articles in a lot are offered in packages or cases the first stage in sampling will be to select at random at least 20 percent of packages or cases. In the second stage from each of the selected cases or packages equal number of articles shall be selected at random so as to make up the number required in col 2 of Table 1. The randomness of selection in both the stages may be ensured by following the procedure of **B-1.3**.

## **B-2. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY**

**B-2.1** All the boats sampled from the lot in accordance with **B-1.2** and **B-1.3** shall be examined for all requirements other than porosity, thermal shock and slag resistance. Any article failing in any one or more of the requirements examined shall be termed as defective. If the number of defectives found in the sample does not exceed the corresponding number given in col 3 of Table 1, the lot shall be considered to satisfy the requirements examined and tested further otherwise the lot shall be rejected without further testing.

**B-2.2** The lot having been declared satisfactory in **B-2.1**, it shall next be tested for thermal shock (*see 7.1*). The number of boats to be subjected to thermal shock test described in **7.1**, shall be in accordance with col 4 of Table 1 and they shall be picked up at random from the non-defective part of the sample in **B-2.1**. If the number of articles failing the test does not exceed the corresponding number given in col 5 of Table 1, the lot shall be considered to satisfy the thermal shock test and tested further, otherwise the lot shall be rejected without further testing.

**B-2.3** The lot having been declared satisfactory in **B-2.2** in respect of thermal shock, it shall next be tested for slag resistance (*see 7.2*). The number of boats to be subjected to slag resistance test described in **7.2** shall be in accordance with col 4 of Table 1 and they shall be picked up at random from the non-defective part of the sample in **B-2.1**. If the number of articles failing the test does not exceed the corresponding number given in col 5 of Table 1 the lot shall be considered to satisfy the slag resistance test and tested further otherwise the lot shall be rejected without further testing.

**B-2.4** The lot having been declared satisfactory in **B-2.3** in respect of slag resistance test, it shall next be tested for porosity (*see 3.2*). The number of articles for this purpose shall be in accordance with col 6 of Table 1 and they shall be picked up at random from the non-defective part of the sample in **B-2.1**. For each selected article water absorption shall be determined by the method described in Appendix A. From the test results of water absorption, the average ( $\bar{x}$ ) and range ( $R$ ) of the test results shall be computed (range being the difference between the maximum and the minimum values of the test results).

The lot shall be declared as conforming to the requirements of this specification if the value of the expression  $(\bar{x} + 0.6 R)$  calculated from the test results is equal to or less than 3 percent, the value specified in **3.2**.

# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Conversion</i>
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s(s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

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